

REMARKS

This paper is responsive to an Office Action dated July 31, 2002. Prior to this amendment claims 1-23 were pending. After amendments to claims 6, 9, 19, and 22, and the addition of claims 24 and 25, claims 1-25 remain pending.

Section 1 of the Office Action objects to claims 6, 19, and 22. In response, the above-mentioned claims have been amended to change "e¹⁷" to -- 10¹⁷--.

In Section 4 of the Office Action, claims 1-3, 12, and 14 have been rejected under 35 U.S.C. 102(b) as being anticipated by Zhang (US Patent 5,569,936). The Office Action states that Zhang teaches a method for forming an LCD device by sputter depositing with a silicon target including a transition metal impurity. This rejection is traversed as follows.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

Zhang, in a single line in the Summary (col. 3, ln. 62-65), mentions that amorphous silicon is formed by sputtering, and that a catalyst can be added in the target material. The subject of Zhang's invention, however, is concerned with forming a Si film through chemical vapor deposition (CVD) processes. In fact, Section 7 of the Final Office Action acknowledges that Zhang does not teach a DC sputtering method.

In the detailed description of the preferred embodiments Zhang specifically describes four production process embodiments. However, none of these embodiments mention the use of a silicon target, embedded with impurities, to form a silicon film, as is recited in the claimed invention. In the

first embodiment (col. 6, ln. 10-11), second embodiment (col. 7, ln. 18-20), third embodiment (col. 8, ln. 41-42), and fourth embodiment (col. 10, ln. 2-4), amorphous silicon is deposited using a CVD process. In short, Zhang does not enable one skilled in the art to use a silicon target including impurities to form a silicon layer as the claimed invention recites in claim 1.

To anticipate, the reference must also enable one of skill in the art to make and use the claimed invention. In re Donohue, 766 F.2d 531, 533, 226 USPQ 619, 621 (Fed. Cir. 1985). Zhang, at col. 3, ln. 60-65, states "...in the case of forming an amorphous silicon film by a physical gas phase method like sputtering, these catalysts can be added in a deposition material like target of deposition source." This one-line mention of sputtering by Zhang clearly does not enable one skilled in the art to perform the steps that are recited in the claimed invention. Neither does Zhang's detailed description of CVD processes enable one to perform the claimed invention sputtering process.

The invention of claim 1 states that the target has a first concentration of a first impurity, and that the resultant silicon film includes a second concentration of the first impurity. The invention of claim 12 recites the sputter deposition of a controlled amount of impurities. Zhang does not teach the use of a particular concentration of impurities in the target, selected to achieve the desired concentration of impurities in the resultant silicon film. Zhang does not describe the concentration of impurities required in the silicon target. Therefore, Zhang does not teach all the elements of the invention of claims 1 and 12, and cannot anticipate the claimed invention. Claims 2, 3, dependent from claim 1, and claim 14, dependent from claim 12, also benefit from the above-mentioned distinctions between the prior art reference and the claimed invention.

The RESPONSE TO ARGUMENTS Section (Section 9) of the Office Action states that it is well known that the "film composition is different

from that of the target". The Office Action further states that, "it would have been obvious to a person skilled in the art to form the target with the required amount of catalyst..." However, these are arguments better made in support of an obviousness rejection. The invention of claim 1 and claim 12 has been rejected as anticipated, not obvious.

This modest flexibility in the rule that "anticipation" requires that every element of the claims appear in a single reference accommodates situations where the common knowledge of the technologists is not recorded in the reference; that is, where technological facts are known to those in the field of the invention, albeit not known to judges. It is not, however, a substitute for determination of patentability in terms of § 103. *Continental Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1268. Alternately, it is requested that the Examiner supply evidence to support the position that persons skilled in the art at the time of the invention knew enough to form a Si film with a second concentration of impurities in response to sputtering with a target including a first concentration of the impurity.

In Section 5 of the Office Action, claims 4, 5, 11, 13, 15, and 16-18 have been rejected as obvious under 35 U.S.C. 103(a) with respect to Zhang. The Office Action states that Zhang "teaches forming the amorphous silicon film from a composite target of silicon and impurity Ni having a concentration of 10^{17} atoms/cm³ in between column 3, line 46 and column 4, line 17." In fact, this cited section discusses neither. The cited Section of Zhang nowhere discusses a target material. This section does state that catalysts can be added to target material, however, only the impurity concentration levels in the resultant silicon film are mentioned. The concentration of impurities in the target material is not mentioned. In fact, the Examiner acknowledges that Zhang fails to teach the use of a single crystal silicon target with a first Ni concentration of 0.01 to 0.5 at%, to form amorphous Si with a second

concentration of Ni. The Office Action states, however, that it would have been obvious to one skilled in the art to form an amorphous silicon film with a second concentration of Ni using a single crystal target with a first concentration of Ni. This rejection is traversed as follows.

An invention is unpatentable if the differences between it and the prior art would have been obvious at the time of the invention. As stated in MPEP § 2143, there are three requirements to establish a *prima facie* case of obviousness.

First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

Generally, as mentioned above, Zhang teaches a process (or four processes) that involve the CVD deposition of amorphous silicon film. Only in one line is the possibility of using a target to sputter deposit amorphous silicon even mentioned. Although the Office Action states that it would have been obvious for one skilled in the art to "form amorphous film with a second Ni concentration from a composite target of single crystal silicon and a first Ni concentration of 0.01 ~ 0.5 atom%...", there is no suggestion in Zhang that any particular concentration of Ni be used to form targets. That is, Zhang does not describe any details sufficient to enable one to build a target with the first concentration of Ni.

"Any judgment on obviousness is in a sense necessarily a reconstruction based on hindsight reasoning, but as long as it takes into account only knowledge which was within the level of ordinary skill in the art at the time the claimed invention was made and does not include knowledge gleaned from applicant's disclosure, such as reconstruction is proper." *In re McLaughlin* 443 F.2d 1392, 1395, 170 USPQ 209, 212 (CCPA 1971). There is no evidence in
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the Zhang reference that a target having a Ni concentration of 0.01 to 0.5 at% was known. The Applicant respectfully submits that the cited prior art is only modified in retrospect, in light of the present invention. The Office Action Response of June 18, 2002, also requested that the Examiner show a motivation, from Zhang or from knowledge generally available to one skilled in the art. The Final Office Action again fails to provide any motivation to support the obviousness rejection. Alternately stated, the Applicant request that the Examiner show how Zhang makes obvious a first Ni concentration of 0.01 – 0.5 atom%....”

The Office Action also states “that the specification contains no disclosure of either the critical nature of the claimed processes or any unexpected results arising therefrom. Where patentability is said to be based upon particularly chosen methods or upon another variable recited in a claim, the Applicant must show that the chosen method or variables are critical ...” In response, the Applicant notes that page 8, ln. 5-15, of specification discusses the issue of sputtering yield. The specification states that the sputtering yield of Ni is 2-3 times higher than the sputtering yield for Si. The recognition of this relationship is reflected in the claimed processes. If the Examiner is rejecting the claimed invention upon an “optimization of ranges” rejection (MPEP 2144.05 II), then a prior art reference with a broader or alternate range of variables must be presented. However, the Examiner has not cited any reference that discusses the concentration of impurities in the target material. Neither has the Examiner presented any references that discuss a process of controlling the relationship between the concentration of impurities in the target and the concentration of impurities in the resultant film.

The Examiner has still not demonstrated that the modification of the cited the prior art reference points to the reasonable expectation of success in the present invention, which is the second requirement of the obviousness

analysis. Again, the Examiner has not responded to Applicant's previous request (made 6/18/02) to show how a modification of Zhang points to the reasonable expectation of success in the claimed invention. In the RESPONSE TO ARGUMENTS Section of the Office Action a reference is presented (Bunshah), which the Examiner states, teaches that the concentration of catalysts in the resultant film is different than the concentration of catalysts in the target. However, if this understanding has existed since 1982 (the date of the reference), the Examiner should be able to show how a modification of Zhang teaches a relationship between the two concentration levels, as is recited in the claimed invention.

With respect to the third requirement to support a *prima facie* case of obviousness, as noted in the response to the anticipation rejection, Zhang does not describe all the elements of either claim 1 or 12. That is, Zhang does not teach the use of a particular concentration of impurities in the target, selected to achieve the desired concentration of impurities in the resultant silicon film. Zhang does not describe the concentration of impurities required in the silicon target. Neither has the Examiner proven that these target concentration levels were well known to those skilled in the art at the time of the invention. Since Zhang neither suggests, nor teaches all the elements of the claimed invention, the Examiner is requested to withdraw the rejection.

In Section 6 of the Office Action, claims 6, 8, 9, 19, 21, and 22 have been rejected under 35 U.S.C. 103(a) as obvious with respect to Zhang, in view of Yamazaki (US Patent 6,306,694). The Examiner acknowledges that Zhang fails to disclose the use of a third concentration of P in the target, and a fourth concentration of P in the deposited film sufficient to create a Vth shift. The Examiner also acknowledges that Zhang fails to teach a first concentration of Ge in the target to form a Si film with a second concentration of Ge and a fourth concentration of P. The Office Action states that Yamazaki teaches the use of

Ge as a crystallization catalyst and the use of dopants to control threshold voltages, and that it would have been obvious to combine the two references so as to make the claimed invention obvious. This rejection is traversed as follows.

Yamazaki describes several processes for forming TFTs suitable for use in an active matrix LCD. The first embodiment describes the deposition of amorphous silicon film "by a known deposition method" and mention is made of a silicon germanium film (col. 7, ln. 24-30). The second embodiment begins at Fig. 4, well after the deposition of amorphous silicon (col. 17, ln. 60-63). Likewise, the third embodiment begins at Fig. 7, at a higher process level (col. 18, ln. 33-34). Embodiment 4 is the same as the first embodiment (col. 19, ln. 33-35), except for the formation of film 104 (col. 19, ln. 40-43), a step that occurs after the deposition of amorphous silicon. Likewise, the fifth embodiment is the same as the first embodiment, and describes differences that occur after the deposition of amorphous silicon (col. 20, ln. 4-9). Embodiment 6 deals with modifications in the laser annealing step (col. 20, ln. 48-51). Embodiments 7 and 8 describe the formation of a protective film overlying the crystallized silicon (col. 21, ln. 19-22 and col. 22, ln. 7-10). Embodiment 9 is similar to embodiment 7 (col. 22, ln. 53-55). Embodiment 11 mentions a CVD process to deposit amorphous silicon (col. 23, ln. 41-44).

In summary, there are a total of 47 embodiments described by Yamazaki. However, none of the embodiments describe an amorphous silicon deposition process that differs from the first embodiment, and the first embodiment just describes deposition by a "known technique". More specifically, Yamazaki does not describe an amorphous silicon sputtering process, or the use of target impurities to form an amorphous silicon film with impurities. When Yamazaki adds impurities, they are always added in a process performed subsequent to the deposition of the amorphous silicon film. For example, in embodiment 25 a catalytic agent is added in an aqueous

solution over the surface of the amorphous silicon (col. 32, ln. 23-31). Likewise, the addition of dopants to specific areas of a subsequently formed transistor are described (col. 4, ln. 13-33). The sputter deposition of an amorphous silicon film including impurities is not described. The claimed invention is different from Yamazaki in that the impurities are deposited as the film is being formed.

The RESPONSE TO ARGUMENTS Section of the Final Office Action states that Yamazaki "teaches that Ni can be used as a catalyst for crystallizing Si...". However, the Examiner has still not provided a motivation to combine the Zhang and Yamazaki references. "Therefore, an examiner may often find every element of a claimed invention in the prior art. If identification of each claimed element in the prior art were sufficient to negate patentability, very few patents would ever issue....To prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the examiner to show a motivation to combine the references that would create the case of obviousness. In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art reference for combination in the manner claimed." *In re Rouffet*, 47 USPQ2d 1453, 1457-1458 (1998).

Further, even if the references could be combined, there is nothing in the Yamazaki disclosure to suggest a modification of Zhang in a way makes the claimed invention of either claim 1 or claim 12 obvious. That is, there is no suggestion in Yamazaki to form a target with a first concentration of impurities necessary to form a second concentration of impurities in a deposited silicon film. Neither reference teaches to use of a target with a first concentration of impurities being used to form a Si film with a second concentration of the impurity. To simply say that Yamazaki teaches to use of Ni as catalyst and that "various forms of sputtering and DC sputtering process is well known in

the art" is not proof of motivation. For example, with respect to claim 6, the Examiner must prove motivation in the prior art that silicon nickel target further include an additional third concentration of phosphorous less than 5×10^{17} atoms/cm³ to create a silicon film with an additional concentration of phosphorous sufficient to create a V_{th} shift in the silicon film.

In Section 10 of the Office Action (RESPONSE TO ARGUMENTS), the Examiner states that the motivation to combine references comes from the fact that "the use of sputtering process, target composition and material characteristics are well known in the semiconductor industry." The Applicant notes that such logic would prevent the allowance of any more patents that concern the sputtering process.

Neither has the Examiner demonstrated that the modification of the combined prior art references point to the reasonable expectation of success in the present invention, which is the second requirement of the obviousness analysis.

The third requirement to support a *prima facie* case of obviousness requires that the combined references disclose all the elements of the claimed invention. However, the convention amorphous silicon deposition processes of Yamazaki, when combined with Zhang still does not teach the use of a particular concentration of impurities in the target, selected to achieve the desired concentration of impurities in the resultant silicon film, or describe the concentration of impurities required in the silicon target. Neither reference describes any kind of Si film sputtering process in detail. Claims 6, 8, 9, dependent from claim 1, and claims 21 and 22, dependent from claim 12, also benefit from the above-mentioned distinctions. Since the cited prior art neither suggests, nor contains all the elements of the claimed invention, the Examiner is requested to withdraw the rejection.

In Section 7 of the Office Action, claims 7, 10, 20, and 23 have been rejected under 35 U.S.C. 103(a) as obvious with respect to Zhang, in view of Yamazaki and the APA (US Patent 6,149,784, Su). The Examiner acknowledges that neither Zhang nor Yamazaki teach DC sputtering, but that the combination of the DC sputtering process described by Su, combined with Zhang and Yamazaki make the claimed invention obvious. This rejection is traversed as follows.

Su describes the use of a shield that can be added to a DC magnetron sputtering reactor to protect the chamber walls from being coated with sputtering material (col. 3, ln. 45-49). Su does not describe the use of silicon targets made with particular concentrations of impurities, or specifics of an amorphous silicon deposition processes.

Again there appears to be no motivation to combine the three references. "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Neither has it been demonstrated that the modification of the combined prior art references point to the reasonable expectation of success in the present invention, which is the second requirement of the obviousness analysis.

The third requirement to support a *prima facie* case of obviousness requires that the combined references disclose all the elements of the claimed invention. However, the DC sputtering process of Su, combined with the convention amorphous silicon deposition processes of Yamazaki and Zhang, still does not teach the use of a particular concentration of impurities in the target, selected to achieve the desired concentration of impurities in the resultant silicon film, or describe the concentration of impurities required in the silicon target. Claims 7 and 10, dependent from claim 1, and claims 20 and 23,

dependent from claim 12, also benefit from the above-mentioned distinctions. Since the cited prior art neither suggests, nor contains all the elements of the claimed invention, the Examiner is requested to withdraw the rejection.

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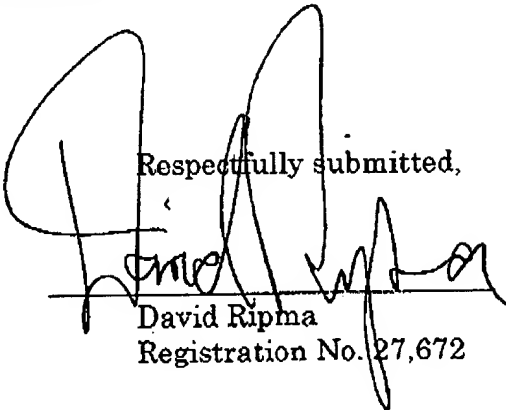
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It is believed that the application is in condition for allowance and reconsideration is earnestly solicited.

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The following pages are a version of the claim amendments with
Markings to show the changes made to claims 6, 9, 19, and 22.

6. (Amended) The method of claim 4 wherein forming a target including silicon and a first concentration of a nickel includes forming the target with an additional third concentration of phosphorous less than 5×10^{17} atoms/cm³; and,

wherein sputter depositing a film of silicon on the substrate including a second concentration of nickel includes depositing a silicon film with an additional fourth concentration of phosphorous sufficient to create a first V_{th} shift in the silicon film.

9. (Amended) The method of claim 8 wherein forming a target including silicon and a first concentration of a germanium includes forming the target with an additional third concentration of phosphorous less than 5×10^{17} atoms/cm³; and,

wherein sputter depositing a film of silicon on the substrate including a second concentration of germanium includes depositing a silicon film with an additional fourth concentration of phosphorous sufficient to create a first V_{th} shift in the silicon film.

19. (Amended) The method of claim 17 wherein forming a target of single-crystal silicon including a first concentration of nickel includes forming a target with an additional third concentration of phosphorous less than 5×10^{17} atoms/cm³; and,

wherein forming an amorphous silicon film including a second concentration of nickel includes forming a silicon film with an additional fourth concentration of phosphorous sufficient to create a first V_{th} shift in the silicon film.

22. (Amended) The method of claim 21 wherein forming a target of single-crystal silicon including a first concentration of germanium includes forming a target with an additional third concentration of phosphorous less than 5×10^{17} atoms/cm³; and,

wherein forming an amorphous silicon film including a second concentration of germanium includes forming a silicon film with an additional fourth concentration of phosphorous sufficient to create a first V_{th} shift in the silicon film.